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RISK MANAGEMENT – HAZARD AND TECHNICAL RISKS

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(A version of this article was published originally in The Mining Chronicle, Vol. 2, No. 11, November 1997.)

Summary

This article addresses one aspect of project risk management, that of process safety and technical hazards. Process safety and technical hazards are managed through a series of hazard studies that develop in depth as the project progresses and more detailed information becomes available. The sophistication of the analysis will depend on the type of process and inventories of hazardous materials that are present, as well as the regulatory requirements. An appropriate balance between qualitative, quantitative and systems studies is required. An unbalanced approach will be an inefficient use of resources and leaves the process vulnerable to the weakest area.

A series of studies starting from the concept stage of a project through to normal operation are outlined in this article. Every project should start with the concept hazard analysis, which will force the project management to outline the series of studies applicable to the project. This series should then be incorporated formally into the Project Risk Management Plan.

Introduction

This article is part of a series dealing with different aspects of Risk Management. This article focuses of the management of process safety and technical hazards. It does not address the details of safety management systems or occupational health and safety.

The purpose of the article is to provide a brief overall summary of the processes involved in the management of process safety and technical risks, to assist the reader in being able to develop the required strategy for the work that they are involved in.

Purpose of Hazard Studies

The purpose of hazard studies is to minimise hazardous activities and the chance of accidents and incidents and to minimise the effects if these accidents if they do occur.

Hazard studies are a systematic checking process and do not replace good design and operation.

Hazard studies include both the management of technical and equipment related hazards and the safety management system that supports that management. Without a good safety management system the process will fail.

Hazard studies are also used to satisfy regulatory and company requirements and to provide documentation and information on the dangers of the facility.

Hazard Study Strategy

The hazard study strategy is to employ a series of studies that increase in detail as the detail of the project is developed. They start with the project concept design and continue through detailed design, construction, commissioning and operation.

The studies aim to identify and assess the hazards and to incorporate the appropriate controls. Some of these controls may be design changes, some may be procedures and systems and some may be contingency and emergency processes and procedures.

The typical series starts with a Concept Hazard Analysis. This study sets the scene. It will identify the requirements of company policies, objectives and responsibilities. It identifies the regulatory requirements. It identifies and documents the applicable safety targets for the project.

It then identifies the major potential hazards of the concept design. Both external such as natural perils, floods etc and hazards of the facility such as inventories of hazardous materials and major moving equipment. At this stage in the project there is the greatest uncertainty, but also the best chance to make significant changes with minimal impacts on cost and schedule. The study also comments on the safety management system to be employed during both the construction and commissioning and the operation of the facility.

Based on the above information the concept hazard analysis can then detail the other hazard studies that will be required over the course of the project and early operation. This series of hazard studies is then incorporated formally into the Project Risk Management Plan.

Following the concept hazard analysis a typical hazard study series may include:

- Preliminary Hazard Analysis, which is to be performed on the preliminary design that is being used to cost the project for company approval and may be required for initial regulatory approval. One key focus of the study is to assess the risks associated with the loss of containment of any hazardous material. It may be necessary to assess the major risks quantitatively in this study. A separate Fire Safety Study may be required if flammable materials are being stored in reasonable quantities.
- Hazard and Operability Studies (HAZOPs), which are performed as detailed design is being completed and draft operational procedures are being considered. The HAZOP study process is a strictly defined process originally developed by the chemical industry, which studies the facility item by item and most commonly uses the process Piping and Instrument Diagrams or equivalent to indicate the item being studied.
- Construction Safety Study, which is normally performed as the construction management plan is being finalised. The key focus is the major construction issues. The Occupational Health and Safety system for the construction should be considered and the performance of the potential contractors reviewed.
- Updated Hazard Analysis, which is normally performed at the time that punch lists or reservation lists are being generated. The aim of the update is to ensure that the facility has been constructed with the required hazard management items installed and that any design change has not affected the hazard controls or introduced new hazards.
- Safety Management System Review, which is performed prior to commissioning and examines the safety management systems, the operation, maintenance and emergency procedures. The review should also examine the preparedness for implementation, ie the standard of training and documentation.

- Hazard Audit, which is performed on the hand over from construction to operations. It is a formal document recording that the facility has been designed and constructed to the required safety standards.
- Final Hazard Assessment, which is performed after several months of operation. The operational practices and procedures are reviewed against those envisaged during the design and construction. Any changes are assessed as to their potential impact on the hazard controls and the generation of any new hazards.

The relevant public authority may require that a Safety Report be produced. This report is largely a combination of several of the above studies. The requirement to reform a safety report is largely based on the sizes of hazardous material inventories. A safety report has two major focuses. One is the safety of the design and the other is the safety management system being used to support it. The key benefit of the report is that it does require a balance between the hardware and software of safety.

Modification Control

The importance of good modification control cannot be over-emphasised. The good work of the designer and the hazard study on that design can be destroyed by a modification that is not managed appropriately.

After the hazard study on a section of the facility has been completed any modification should be documented and assessed as to whether it has the potential to impact on the safety of the design or the processes and procedures. If there is this potential then the section should be re-studied with the modification incorporated.

Quantitative versus Qualitative versus Systems

The optimum use of resources to achieve the desired outcome can be achieved by using the appropriate balance of qualitative, quantitative and systems study processes.

Qualitative assessment should be used as a basis. Where the hardware systems are complicated and necessary for protection then quantitative assessment may be required. In general quantitative assessments are applicable to equipment failures and less applicable to human error or faulty human responses.

The regulatory authorities may require a quantitative assessment. It provides a useful comparison and there are some generally accepted criteria against which the assessment results can be gauged.

Care must be taken in the use of quantitative analysis, although highly appropriate in many cases it has the potential to monopolise the process and consume resources, which could be put to better use elsewhere. Also if the information on which the analysis is based is not good, then neither will be the analysis. Finding the balance between quantitative and qualitative analysis would be the subject of an article on its own.

The third element to be balanced is that of the systems study. Good hardware can easily be defeated by poor systems. Two of the largest disasters, the disaster in Bhopal India in 1984 where approximately 2500 people where killed by a release of Methyl Iso-cyanate, and the Piper Alpha oil platform disaster in 1988 in the North Sea where 167 people were killed by a fire, are examples of where the hardware was let down by poor systems.

Conclusion

As part of managing the risks associated with a project a series of hazard studies should be performed. The first study, the concept hazard analysis, being the scene setter that defines the other studies to be performed. This series is then documented in the project Risk Management Plan.

The studies must be balanced, that is they must examine the technical/hardware issues qualitatively and where appropriate quantitatively and also examine the systems issues. Poor systems can negate the aspects of good design and hardware.

The other potential destroyer is poor modification control. Changes after hazard studies have been performed need to be documented and the changes re-studied as required.

Getting the right strategy in place will reduce the overall effort required to get the optimum result.

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